

## ICT'08 : The iCub and friends forum

MACSi: Motor, Adaptive and Cognitive Scaffolding for iCub  
Project supported by the RobotCub OpenCall

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# Scope of this presentation

- 1 A word about the partners of the project
- 2 Main goals of the MACSi Project
- 3 Description of the work packages
- 4 Dissemination and communication

# A word about the partners of the project: UPMC - ISIR

## Université Pierre et Marie Curie (UPMC) - Paris

- A “Science” university
- 32000 students
- 10000 staff among which 5600 researchers
- 160 laboratories
- 3500 PhD candidates



## Institut des Systèmes Intelligents et de Robotique (ISIR)

- A “young” CNRS research lab. (UMR 7222) born from the fusion of three different labs in jan. 2007: LIP6/AnimatLab, LRP, LISIF/PRC
- ~100 people among which 30 faculties
- Lab. director : Prof. Philippe Bidaud
- 3 research groups:
  - Interactive Systems: micro/nano-manipulation, surgical robotics
  - Mobile and autonomous Systems: bio-inspired robotics, mobile robotics, autonomous systems
  - **Perception and Motion** : Human and artificial perception, motion analysis, rehabilitation, humanoid robots control
- 4 people directly involved in the MACSi project. Leader : **Olivier Sigaud**

# A word about the partners of the project

## INRIA : Projet Flowers - Bordeaux

- Flowers : FLOWing Epigenetic Robots and Systems
- INRIA research team on developmental and social robotics
- A team of 5 people headed by : **Pierre-Yves Oudeyer**



## ENSTA : The Cognitive Robotics Team - Paris

- A team of the Computer Science and Electronics Lab. at ENSTA
- A team of 3 people headed by: **David Filliat**



## Gostai - Paris

- A company developping software for Robotics
- URBI: a universal Robotics software platform providing a scripting language with dedicated features to deal with parallelism, event-based programming and distributed objects.
- A team of ~10 people headed by: **Jean-Christophe Baillie**



# Main goals of the MACSi Project

## Central target of MACSi

Build mechanisms allowing a robot to efficiently develop **new basic sensorimotor skills** through both:

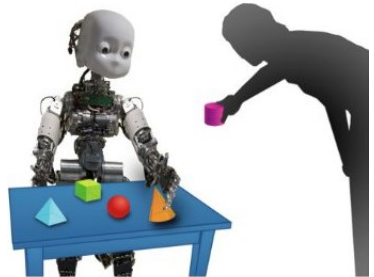
- autonomous exploration
- social interaction with humans

in partially unknown environments.

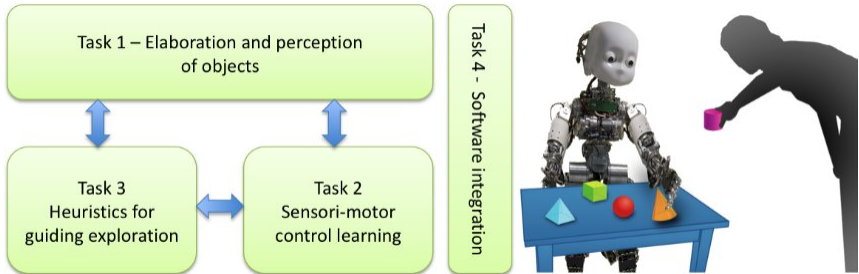
## Goal experiment

An experiment in which a robot will:

- progressively build perceptuo-motor abstractions and representations allowing him to differentiate its body from external objects;
- learn how to control its body to manipulate these surrounding objects;
- driven both by intrinsic motivation, i.e. artificial curiosity, and social guidance provided by a human partner.



# Overview of the MACSi project



# Description of the work packages : 1 - perception workpackage

Perception work package: Elaborating objects through the organization of perceptual spaces into proto-objects

> Workpackage main investigator: ENSTA

> Main steps:

- Tagged objects localization in the Cartesian world coordinates and social cues recognition software implementation in Urbi for iCub;
- Proto-object model and software implementation of this model;
- “Human” category discovery;
- “Self” category discovery;
- “Manipulable object” category discovery;
- Final object category learning capacity including all objects type implemented in Urbi for iCub.

## Description of the work packages : 2 - motor learning workpackage

Motor learning work package: Learning motor control and motor representations driven by intrinsic motivations and social guidance

> Workpackage main investigator: ISIR

> Main steps:

- Basic 3D reaching skill implemented in an Urbi package for iCub;
- Learned 3D reaching skill implemented in an Urbi package for iCub;
- Learned motor models of interaction with objects, identification of the domain of unusual effects;
- Motor skills with task specified in the visual frame of reference implemented in an Urbi package for iCub;
- Comparison between motor skills realised with task specified in the visual frame of reference and task specified in the external world Cartesian frame of reference.



## Description of the work packages : 3 - exploration guidance

### Exploration guidance work package: Heuristics for guiding exploration - Intrinsic Motivation and Social Incentives

- > Workpackage main investigator: INRIA
- > Main steps:
  - Algorithm and software for a bottom-up region growing version of the IAC exploration heuristics that scales in high-dimensions;
  - Algorithm and software for competence-based intrinsic motivation system;
  - Systematic comparison in simulation and on the real iCub of the two intrinsic motivation systems;
  - Algorithm and software for coupling a new variant of IAC and social cheering, allowing to guide the exploration and collection of learning example for the sensorimotor learning algorithms of WP 2;
  - Algorithm and software for coupling intrinsic motivation with social cheering and stimulus enhancement, usable for the final demonstration of the iCub.

## Description of the work packages : 4 - Integration

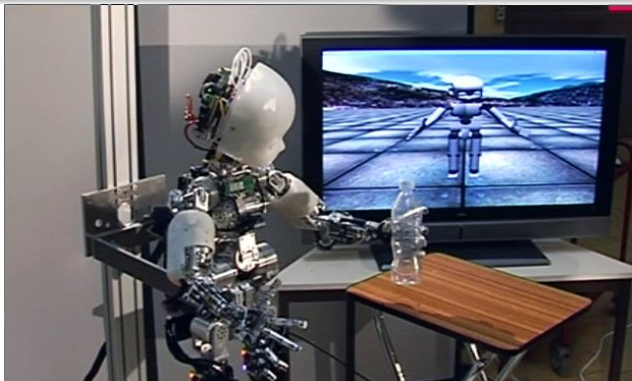
### Exploration guidance work package: Global architecture design, software integration and demonstrations

- > Workpackage main investigator: Gostai
- > Main steps:
  - Detailed specification of the project architecture in terms of representations and interfaces between task-related components;
  - Urbi server for iCub. Development kit for Urbi modules;
  - Basic YARP modules integrated as UObjects;
  - Urbi platform for iCub ported on the simulator reliably providing equivalent behaviour;
  - Demonstration of separate components corresponding to the first software deliverables of WP 1, 2 and 3;
  - Intermediate and final demonstrations of integrated architecture incrementally including all advanced versions of components based on learning + videos.

# Dissemination and communication

## Outcome of the project

- Creation of a web site. Progress can also been followed at : [http://eris.liralab.it/wiki/UPMC\\_iCub\\_project](http://eris.liralab.it/wiki/UPMC_iCub_project);
- Urbi for iCub software package made available online;
- All Open Source code made available with user manuals on the web site;
- Movies of the experimental demonstrations made available online.



Thank you for your attention.

